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Bulletin No. SCD1-B
Drawing No. LP0172
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MODEL SCD - 100 KHZ PRESETTABLE COUNTER WITH 0.43" (11 MM) L.E.D. DISPLAY

- *AVAILABLE IN 4 or 6-DIGIT VERSIONS*
- *COUNT INPUT PROGRAMMABLE FOR ALL STANDARD SENSORS & FOR COUNT SWITCHES*
- *RESET ON POWER-UP*
- *TWO COMPLEMENTARY SOLID-STATE OUTPUTS*
  1. Primary output to drive control relay
  2. Auxiliary output (inverted) for external circuitry.
- *CONTROL INPUTS FOR:*
  1. Remote Reset
  2. Count Inhibit
  3. Up/Down Count Direction
  4. Display Blanking for Battery Backup
- *PROGRAMMABLE RESET-TO-ZERO (RTZ) OR RESET-TO-PRESET (RTP) ACTION, EACH WITH 4 RESET CYCLE MODES*

DESCRIPTION

This high-performance presettable counter is based on solid-state technology proven in tens of thousands of field applications, and incorporates features that have made it an industry standard. With dual complementary outputs, input configuration programmability, selectable reset cycle modes and a full complement of control inputs, the Model SCD can handle practically any application for single level preset counting.

The Model SCD features two selectable counting actions. With RTZ *(Reset-to-Zero)* action, the counter resets to zero and counts up, actuating the outputs when it reaches the preset value. When RTP *(Reset-to-Preset)* action is selected, the counter is loaded with the preset number at the start of a cycle and counts down to activate the outputs when the count reaches zero.
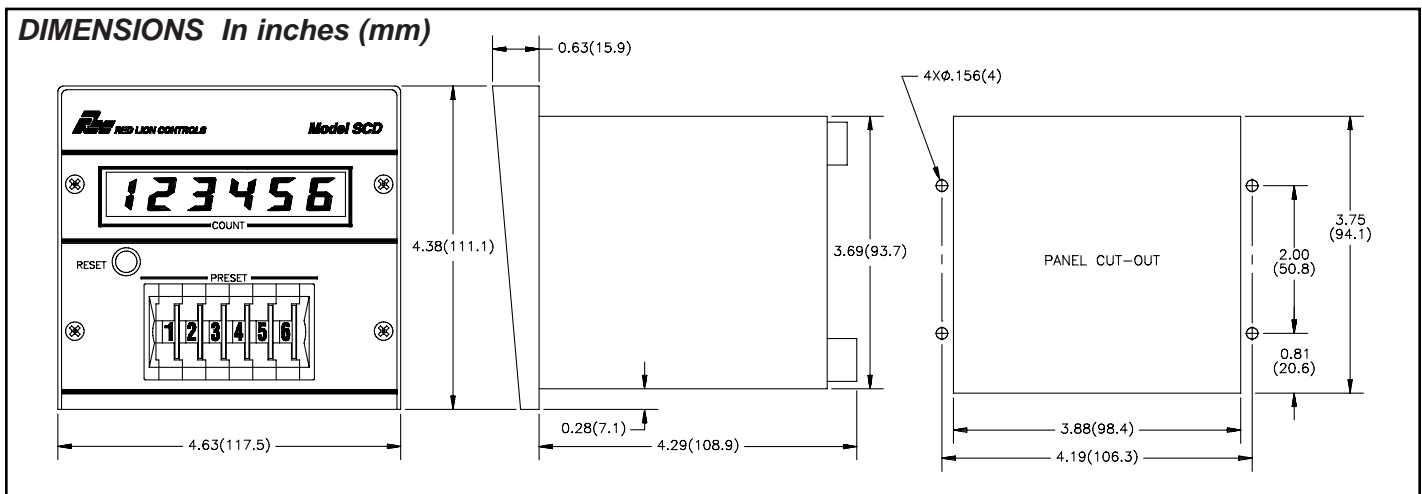
The preset value entered on the thumbwheel switches is loaded at the end of a cycle *(when the outputs are active)* and during reset time. This prevents inadvertent changes in the preset number once a run has started and also avoids accidental over-runs that can occur with counters that allow "setting-on-the-fly".

Electrical connections are made to terminal strips on the rear of the unit. These pressure clamp screw terminals accept stripped wires up to #12 AWG and do not require lugs.
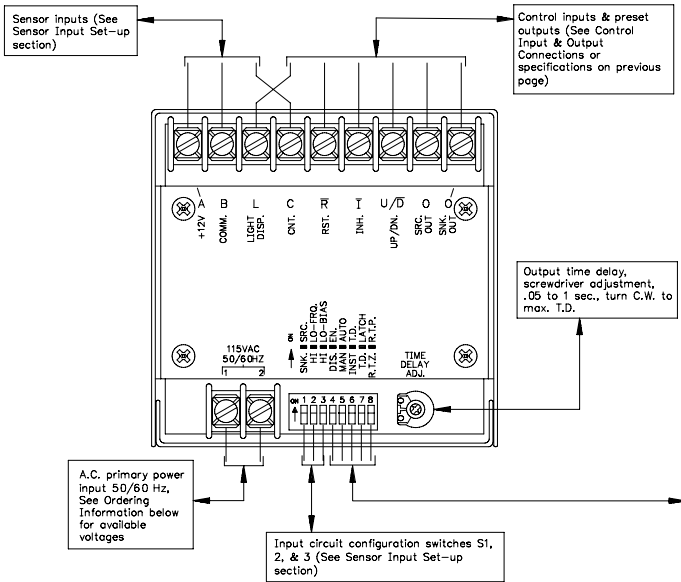
* - See SC Series Sensor Input Connections & Input Configuration Switch Set-up, Note 1.

SPECIFICATIONS

1. **PRIMARY SUPPLY VOLTAGE:** Available in two voltage ranges. 115/230 VAC (±10%), 50/60 Hz, 11.2 VA. Also operates from +12 VDC Supply *(See Application Notes)*.
2. ***SENSOR OUTPUT POWER (TERM."A"):** +12 VDC ±15% @ 100 mA.
3. **RESET & PRESET TIMING PARAMETERS:**
   A. COUNT-AFTER-RESET - With RTZ action new counts can be accepted 7.5 µsec after reset. With RTP action new counts can be accepted 1 msec after reset.
   B. Preset loading occurs on timed output or reset.
4. **OUTPUTS:**
   SNK OUT - Primary output *(current sinking)* to drive control relay, 100 mA max. This output goes low when preset count (RTZ) or zero count (RTP) is reached.
   SRC OUT - Aux. Output *(inverted)* operates synchronously with O_{SNK} to deliver +12 VDC @ 10 mA.
5. **CURRENT DRAIN FROM BATTERY BACKUP:** 60 mA with displays blanked and without sensor or output loads. 350 mA *(6-digit)*, 260 mA *(4-digit)* with full display on *(all 8's)* but less sensor and output load.
6. **OPERATING TEMPERATURE RANGE:** -20º to +50ºC
7. **CONSTRUCTION:** Steel Case, Aluminum Bezel, Aluminum Front Panel with polycarbonate Overlay, Black Epoxy Paint Finish.
8. **WEIGHT:** 2.0 lbs. (0.91 Kg)

DIMENSIONS In inches (mm)

MODEL SCD INPUT/OUTPUT CONNECTIONS & PROGRAMMING SWITCHES

Sensor inputs (See Sensor Input Set-up section)

Control inputs & preset outputs (See Control Input & Output Connections or specifications on previous page)

Output time delay, screwdriver adjustment, .05 to 1 sec., turn C.W. to max. T.D.

A.C. primary power input 50/60 Hz, See Ordering Information below for available voltages

Input circuit configuration switches S1, 2, & 3 (See Sensor Input Set-up section)
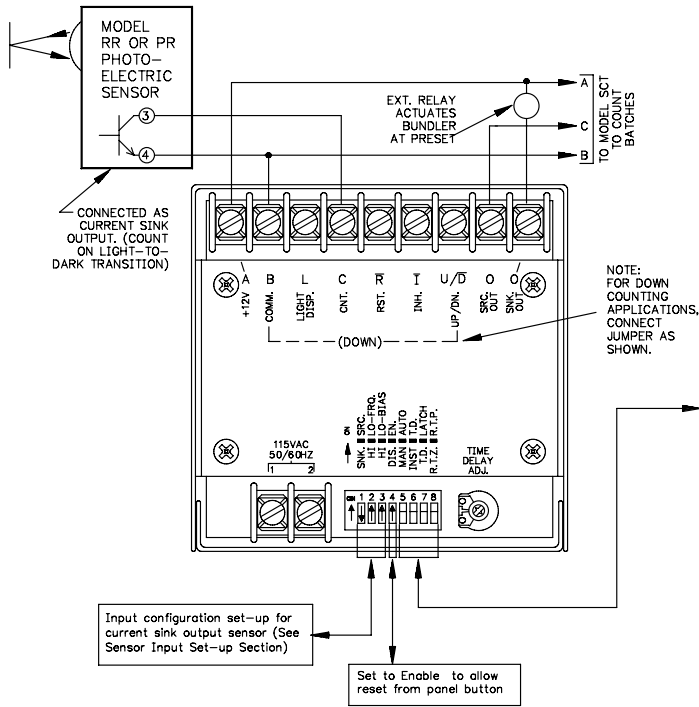
RESET MODE & CYCLE SWITCHES

S4 - ON: ENABLES Front Panel Reset Button
OFF: DISABLES Front Panel Reset
S5 - ON: AUTO RST* - Causes counter to automatically reset upon reaching the preset count. Reset may be instantaneous or maintained for the duration of the output time delay. (See S6)
OFF: MAN. - Counter will reset only in response to Front Panel Button (if ENABLED) or Remote Reset ($\overline{R}$).
S6 - ON: T.D. RST* - Counter automatically resets at preset (with S5 ON) and is held at reset for duration of time-out.
OFF: INST* - Counter automatically resets at preset (with S5 ON) and is instantly ready to accept new counts.
S7 - ON: LATCH - causes outputs to latch after reaching preset. Outputs stay ON until manually reset by Front Panel Button or Remote Reset.
OFF: T.D. - Allows outputs to respond to normal time delayed dropout.
S8 - ON: R.T.P. (Reset-to-Preset) - Counter resets to the number entered in on thumbwheel Preset Switches, and outputs activate when count reaches zero. (Jumper req'd from U/$\overline{D}$ to B for down counting.)
OFF: R.T.Z. (Reset-to-Zero) - Counter resets to zero and outputs activate when count reaches number entered on T.W. Preset Switches.

* Remote reset ($\overline{R}$) and Front Panel Reset (if ENABLED) will always take precedence and reset the counter regardless of automatic setup mode used.

TYPICAL APPLICATION CONNECTIONS & SET-UP

A Preset counter application using photo-electric sensing to count products making up a *"batch" (case, carton, bundle or other group)*. At the end of each *"batch", "SNK OUT"* output actuates a bundler and the *"SRC OUT"* output signals a Model SCT which totalizes batches. Terminals *"A"* and *"B"* of Model SCT are paralleled with SCD to share load.

MODEL RR OR PR PHOTO-ELECTRIC SENSOR

CONNECTED AS CURRENT SINK OUTPUT. (COUNT ON LIGHT-TO-DARK TRANSITION)

EXT. RELAY ACTUATES BUNDLER AT PRESET

TO MODEL SCT TO COUNT BATCHES

NOTE: FOR DOWN COUNTING APPLICATIONS, CONNECT JUMPER AS SHOWN.

(DOWN)

Input configuration set-up for current sink output sensor (See Sensor Input Set-up Section)

Set to Enable to allow reset from panel button

ORDERING INFORMATION

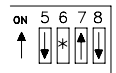| MODEL NO.	DESCRIPTION	NO. OF DIGITS	PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGE	
			230 VAC	115 VAC
SCD	100 KHz 1-Preset Counter w/Display	4	SCD00411	SCD00401
		6	SCD00611	SCD00601
For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.				

RESET CYCLE MODES - SWITCHES S5, 6, 7 & 8

Reset cycle modes below are shown for Reset-to-Zero action *(RTZ, S8-OFF)* where the reset returns the count to zero and the counter then counts up, activating the outputs at the preset value. Reset-to-Preset action *(RTP, S8-ON)* is just the reverse, and a reset loads the preset value in the counter, the counter counts down (jumper from U/$\overline{D}$ to B required) and activates the outputs when the count reaches zero. The reset cycle modes for RTP action are identical to those described below if the terms "zero" and "preset" are interchanged and with the one exception that 1msec is required after reset *(instead of 7.5 µsec)* before a new cycle count can be accepted.
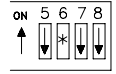
MODE 1 LATCH AT PRESET, MANUAL RESET
Counts from zero, activates and latches outputs ON at preset. Front panel button *(if enabled)* or remote reset (Term. "$\overline{R}$"), returns counter to zero and deactivates outputs. Accepts new count pulses 7.5 µsec after reset is removed.
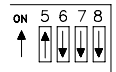
MODE 2 MOMENTARY OUTPUT AT PRESET, MANUAL RESET
Counts from zero and activates outputs momentarily at preset. Momentary output time is adjustable from 0.05 to 1 second. Count can proceed upward if not reset, and if count direction is then reversed, by pulling U/$\overline{D}$ down to B, the outputs will again reactivate as the count decrements down through preset a second time. Output activates each time count passes through preset provided time-out from the previous pass has concluded. Front panel reset *(if enabled)* or remote reset ($\overline{R}$) returns the counter to zero and interrupts output if time-out has not concluded. Unit is ready to accept new counts 7.5 µsec after removal of reset.
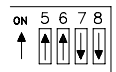
MODE 3 AUTOMATIC CYCLE - RESET & RUN AT PRESET
Counts from zero, activates outputs momentarily at preset and simultaneously resets counter to zero, ready to accept new counts for next cycle 7.5 µsec after resetting. Momentary output time is adjustable from 0.05 to 1 sec. Output ON-time must be less than time required to count from zero to reset for proper Mode 3 operation.
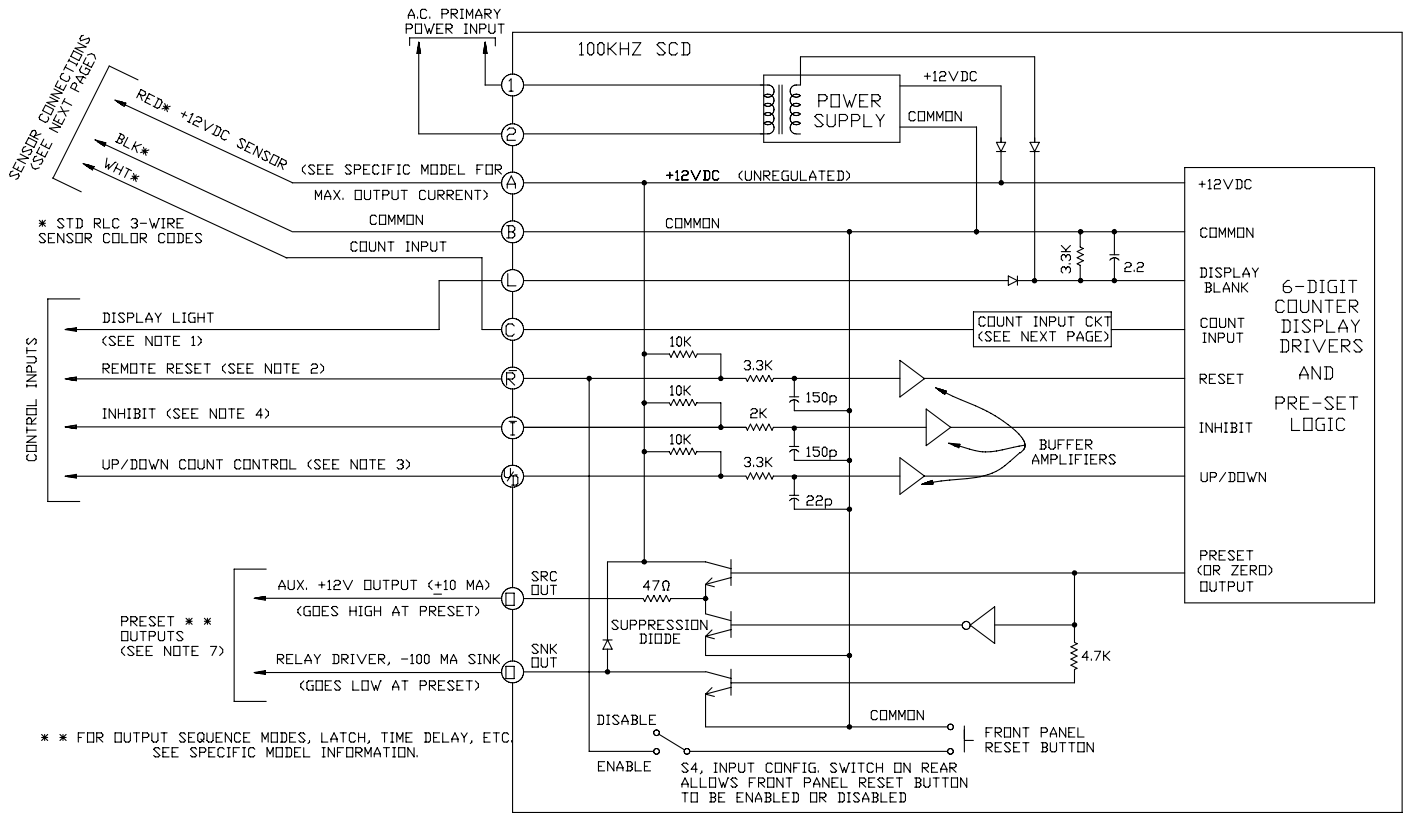
MODE 4 AUTO. CYCLE - RESET & RUN AFTER TIME-OUT
Counts from zero, activates outputs momentarily at preset. Counter resets at preset, holds in reset for duration of time out, and will accept new counts 7.5 µsec after time out concludes.
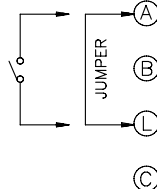
* - Switch 6 may be either ON or OFF.
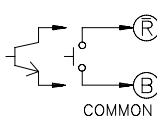
NOTES:

1. BATTERY BACK-UP & DISPLAY LIGHT (L) OPERATION

SC Counters can be operated from +12 VDC batteries or power supplies. *(+12 VDC is connected to Term. "A" and minus to "B")*. When the counter is powered by +12 VDC, and Term. "L" is pulled high to "A", the display will remain activated and all counter functions will operate. When Term. "L" is opened the counter will continue to accumulate counts, with display blanked to conserve power *("L" is normally held high by applied A.C. line voltage)*.
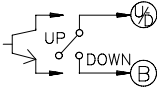
   With SCD preset counters, opening "L" while operating from +12 VDC also disables the preset entry function. This can cause an aborted count accumulation if a preset level is reached after a line-failure. A normally-closed contact should be used to connect "L" to "A" when these counters are battery-backed. This allows normal operation to continue on power-loss until the machine comes to a stop. Then the switch can be opened to conserve power. *(For Non-Interruptible Power Supply see Accessory Section of the Catalog)*

2. REMOTE RESET ($\overline{R}$) - Counter will be reset when this input is pulled low *(to Term. "B")* by a remote contact or NPN O.C. output. Response time to Reset input is 2 μsec. Counter is ready to accept new counts 7.5 μsec after removal of reset. *(Front panel reset button on all Models may be enabled or disabled via configuration switch on rear.)*
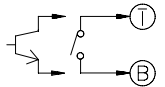
3. UP/$\overline{DOWN}$ (U/$\overline{D}$) - With U/$\overline{D}$ Terminal open counters increment *(count "UP")* to increase the accumulated number. When U/$\overline{D}$ is pulled low the counter will decrement *(count "DOWN")* to decrease the accumulated number. Response time to change count direction is 2 μsec.

Note: SC Counters count in complementary numbers when counting down through zero, i.e. the counting sequence when decrementing is 3, 2, 1, 0, 999999, 999998, 999997, etc.

4. INHIBIT ($\overline{I}$) - Counter is inhibited from accepting counts as long as *"$\overline{I}$"* is pulled low to Term. *"B"*. Response time for initiation is 2 μsec, and release is 4 μsec.

5. OUTPUTS (Preset Counters) - All SC Presettable counters have 2 complementary outputs per preset level *(Models SC2DU and SC2DD have two sets of outputs, one set for each preset level)*.

   SNK OUT - Primary output for driving a relay coil. Output goes low to energize relay at end of count cycle. This output is rated $V_{OL} = 0.6$ V @ 100 mA, $V_{OH} = 12$ V max. *(Internal suppression diode limits V_{OH} to +12 V internal supply and higher external supply cannot be used.)*

   SRC OUT - Auxiliary output goes high at end of a count cycle. This output is actually Bi-Polar, will source or sink 10 mA, and may be used for count input to other counters or external electronic control circuits.

6. RESET-TO-PRESET (RTP) & RESET-TO-ZERO (RTZ) ACTION

SC Presettable Counters when Reset, return the counter either to zero or to the Preset value *(Start Count)* as determined by the Reset Action.
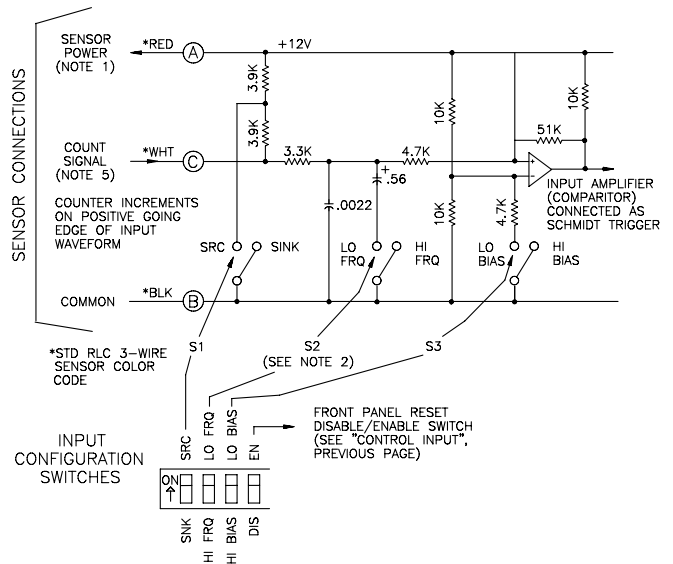
MODEL SCP - Fixed RTZ action
MODEL SCD - Programmable for RTZ or RTP action

   Reset actions do not determine UP/$\overline{DOWN}$ count direction. Count direction is controlled only by the U/$\overline{D}$ terminal which must be connected to *"B"* when down-counting is required.

SENSOR INPUT CONNECTIONS & INPUT CONFIGURATION SWITCH SET-UP

The schematic diagram at right shows the details of the 100 KHz SCD count input circuit, the terminals used for sensor connection and the configuration set-up switches. These switches are the first three switches in the switch bank and are designated S1, S2 and S3 from left to right. The functions of these switches are as follows:

S1 - ON (SRC): Provides 3.9 KΩ Pull-down load for sensors with sourcing outputs. *(Max. sensor current, 3 mA)*

OFF (SNK): Provides a 7.8 KΩ Pull-up load for sensors with sinking outputs. *(Max. sensor current, 1.6 mA)*

S2 - ON (LO FRQ): Connects damping cap for switch contact debounce. Limits count speed to 100 cps maximum. Min. count pulse ON/OFF times-5 msec. *(See Note 2)*

OFF (HI FRQ): Removes damping cap, allows operation to 100 KHz. Min count pulse ON/OFF times-5 µsec.

S3 - ON (LO BIAS): Sets input trigger levels to the low range to accept logic pulses with 0 to +5 V swings. *($V_{IL} = 1.5$ V, $V_{IH} = 3.75$ V, See Note 3)*

OFF (HI BIAS): Sets input trigger levels at mid-range to accept outputs from 2-wire proximity sensors, resistive photo-cells and logic pulses with full 0 to +12 V swings. *($V_{IL} = 5.5$ V, $V_{IH} = 7.5$ V, See Note 3)*

CONNECTIONS & CONFIGURATION SWITCH SET-UPS FOR VARIOUS SENSOR OUTPUTS

COUNT SWITCH OR ISOLATED TRANSISTOR OUTPUTS
CURRENT SOURCE CONNECTED (INCREMENT ON CLOSING)
CURRENT SINK CONNECTED (INCREMENT ON OPENING)
FOR INPUT VOLTAGES ABOVE +12V, SEE NOTE 5
*SEE NOTE 2
RLC SENSOR MODELS: MPS, RR & PR PHOTO ELECTRICS

SENSORS WITH CURRENT SINK OUTPUT (NPN O.C.) (INCREMENTS ON TURN-OFF)
RLC SENSOR MODELS: LMPC, ASTC, PSAC, RPGC, RPGB, RPGH, LSC
SHIELD (SEE NOTE 4)
SENSOR
NPN O.C. OUTPUT
CONNECTOR PIN DESIGNATOR FOR RPGB & RPGH
*SEE NOTE 2

SENSORS WITH CURRENT SOURCE OUTPUT (PNP O.C.) (INCREMENTS ON TURN-ON)
*SEE NOTE 2

TWO WIRE PROXIMITY SENSORS CURRENT SOURCE CONNECTED (INCREMENT ON CURRENT RISE)
RLC SENSOR MODELS: PSA-1 PSA-2
*SEE NOTE 2

OTHER STYLE, SENSORS WITH -EF UTPUT CURRENT SOURCE CONNECTED (INCREMENT ON + EDGE)
SENSOR WITH +5V EMMITTER-FOLLOWER OUTPUT
*SEE NOTE 2
RLC SENSOR MODELS: LMP-EC, 715

A.C. INPUTS FROM MAG PICKUPS, TACH. GENERATORS, INVERTERS, ETC.
+12V ZD
FILTER CAP
*SEE NOTE 2
AC SIGNAL SOURCE
RESISTOR TO LIMIT CURRENT (SEE NOTE 5)
A.C. SIGNALS OVER 50 VAC, RMS SHOULD BE COUPLED THROUGH AN ISOLATION TRANSFORMER

INTERFACING WITH CMOS CIRCUITRY (B TYPE)
+12V
COMMON
NOTE: IF EXTERNAL SUPPLY IS USED TO POWER CMOS CIRCUIT, VOLTAGE MUST BE EQUAL TO OR GREATER THAN TERM. A VOLTAGE.

INTERFACING WITH TTL
CLAMP DIODE +5V
NOTE: CIRCUIT SHOWN FOR STANDARD TTL GATE OUTPUT. TTL CIRCUITS ARE AVAILABLE WITH NPN O.C. OUTPUT ELIMINATING NEED FOR THE CLAMP DIODE.

1. SENSOR SUPPLY VOLTAGE AND CURRENT
   Sensor supply voltage on Term. "A" is +12 VDC nominal with ±15% variation due to line and internal load variation. *All RLC sensors will accommodate this variation)*. Maximum sensor current rating varies depending on the specific counter model *See Specifications of specific model)*. This rating is the maximum allowable sensor current when all digits of a 6-digit unit display 8's, and with 100 mA relay load*(s)* on preset counters. If all 6 digits are not used, an additional 45 mA is available for each digit not displayed. 4-digit models will deliver an additional 90 mA over the current rating stated. SC counter power supplies are not regulated, and in multiple counter *(or counter/tachometer)* installations all terminal "A's" and "B's" can be paralleled for load sharing. For unusually high sensor current requirements, use Accessory Power Supply *(See Accessory Section of Catalog)*.

2. HI/LO FRQ. SELECTION
   The HI/LO FRQ Selection switch <u>MUST</u> be set on LO FRQ when switch contacts are used to generate count input signals. Since the LO FRQ mode

also provides very high immunity against electrical noise pickup, it is recommended that this mode also be used whenever possible with electronic sensor outputs, as added insurance. The LO FRQ mode can be used with any type of sensor output provided count pulses never decrease below 5 msec, and the count rate does not exceed 100 cps.

3. V_{IL} and V_{IH} levels given are nominal values ±10% when counter voltage on terminal A is +12 VDC. These nominal values will vary in proportion to the variations in Terminal A voltage caused by line voltage and load changes.

4. When shielded cable is used, shield should be connected to terminal B at counter and left unconnected at sensor end.

5. The Count Input *(Terminal C)*, can accept source pulses from other circuits up to +28 V in amplitude. For voltages above +28 V a limiting resistor and zener diode should be used to limit the voltage at Terminal C. Negative input voltages to Count Input *(Terminal C)*, will damage the input circuit. If the possibility exists that the input voltage can swing negative, an external shunt or series diode should be used to block the negative swing.